

COST EVALUATION FOR NINE FEDERAL MOTOR VEHICLE STANDARDS VOLUME V FMVSS 213

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**NOVEMBER 1979
FINAL REPORT**

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16. Abstract <p>The consumer cost was established for the implementation cost of each of the nine Federal Motor Vehicle Safety Standards. The standards study are:</p> <ul style="list-style-type: none"> FMVSS 105 Hydraulic Brake Systems on Passenger Cars FMVSS 108 Side Marker Lamps FMVSS 122 Motorcycle Brake Systems FMVSS 202 Head Restraints FMVSS 207 Seating Systems FMVSS 213 Child Seating Systems FMVSS 220 School Bus, Rollover Protection FMVSS 221 School Bus, Joint Strength FMVSS 222 School Bus, Seating and Crash Protection <p>For each standard a representative sample of makes and models of vehicles or components was established. The components required to meet the standard were purchased and their costs estimated. The first year of the imposition of the standard and the year immediately preceding it were emphasized. By analysis, the consumer costs attributed to the standard for each make and model or components were determined. A weighted average was developed from the samples and applied to the total industry volumes to determine the consumer cost for the implementation of each standard. The weighted average of weight variance due to the implementation of the standard was also determined. The before and after cost variance was not applied to FMVSS 213 Child Seating Systems and the FMVSS 122 Motorcycle Brake Systems.</p>			
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METRIC CONVERSION FACTORS

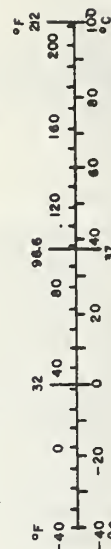
Approximate Conversions to Metric Measures

Symbol	What You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tap	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 exactly. For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10.286.

Approximate Conversions from Metric Measures

Symbol	What You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



ABSTRACT

FMVSS 213 CHILD SEATING SYSTEM

Under Contract DOT-HS-02015 the Contractor conducted a program to determine the cost and weight of several popular infant and child seats. The seats were purchased, torndown to basic components, cost and manufacturing processing methods applied to derive variable cost, specimens photographed and costs extended by use of the Macro-Analysis Method to develop Wholesale and Consumer Cost.

Consumer cost varied for infant seats from \$20.00 to \$26.50 and the weight varied from 1.5 to 8.8 pounds. consumer cost of the child seat varied from \$40.97 to \$49.95 and the weight varied from 8.8 pounds to 10.8 pounds.

No suggested retail price existed on specimens purchased.

PREFACE

The Contractor, the De Lorean Motor Company, in the presentation of the Final Report on the Cost Evaluation for Nine Federal Motor Vehicle Standards has divided the report into six major categories. Each volume contains the complete study related to the designated standard or standards. The Contractor acknowledges the contribution of its staff, the automotive manufacturing community and the automotive dealers. Special acknowledgement is made to the Contract Technical Manager, Mr. Robert Lemmer of the National Highway Traffic Safety Administration, Department of Transportation, for his contributions and timely reviews throughout the program.

The cost estimating techniques employed in the study are based on automotive industry practice and have been previously used on other programs by the Contractor. The following listing includes recent and current programs using essentially the same estimating procedures and techniques as those employed in this study:

- Contract NHTSA-DOT-HS-7-01770

Development of a Motor Vehicle Materials Historical, High-Volume Industrial Processing Rates
Cost Data Bank - Ford F-100 Truck

FMVSS 201 Study of passenger car requirements as applied to light trucks and vans.

FMVSS 203 and 204 Study of passenger car requirements as applied to light trucks and vans.

- Contract NHTSA-DOT-HS-8-01767
Cost Evaluation of Four Federal Motor Vehicle Safety Standards.

Cost Review of Pedestrian Safety Modifications.
- Contract NHTSA-DOT-HS-9-02258
Cost Evaluation of Three Federal Motor Vehicle Safety Standards.
- Renault USA, Inc.
Consumer Cost Estimate of Subcompact Vehicles.
- De Lorean Motor Company
Manufacturing Cost Studies of Components of lightweight vehicles.
- Contract NHTSA-DOT-HS-9-02112
Preliminary incremental cost estimating for the implementation of the extension of FMVSS 105 to light trucks, vans and MVTs.

Study the cost and weight change for passenger car pedestrian initial impact protection implementation.

Product feasibility, consumer cost and implementation schedule analysis for implementing brake inspectability requirements.

Cost data developed on this program for automotive standards are based on 1979 Model Year Economics and 1978 macro-analysis of automotive and component manufacturers. For standards related to other than automotive manufacturers,

the data is based on 1979 year economics and macro-analysis factors applicable to the manufacturers. Dealer discount on related automotive products was established at 16.97% for the industry. A dealer discount of 25% was applied for the motorcycle related products. The child seats dealer discounts varied from 40% to 50%. Distributor cost where applicable is reflected in the dealer wholesale cost.

In reviewing this report, the reader is cautioned that the application of an average cost per pound factor that can be developed from the data presented could result in serious cost errors. Cost data can only effectively be developed by using manufacturing processing personnel applying automotive cost estimating technology. For any cost factor to be effective the designs, size, construction, and manufacturing techniques must be nearly the same. In this report a considerable variation can be noted in the cost and weight of what appears to be similar components. Only a detailed review of these components would explain the variation.

PROGRAM INDIX

VOLUME I	- FMVSS 105	HYDRAULIC BRAKE SYSTEMS ON PASSENGER CARS
VOLUME II	- FMVSS 108	LAMPS, REFLECTIVE DEVICES AND ASSOCIATED EQUIPMENT
VOLUME III	- FMVSS 122	MOTORCYCLE BRAKE SYSTEMS
VOLUME IV	- FMVSS 202	HEAD RESTRAINTS
	FMVSS 207	SEATING SYSTEMS
VOLUME V	- FMVSS 213	CHILD SEATING SYSTEMS
VOLUME VI	- FMVSS 220	SCHOOL BUS, ROLLOVER PROTECTION
	FMVSS 221	SCHOOL BUS, JOINT STRENGTH
	FMVSS 222	SCHOOL BUS, SEATING AND CRASH PROTECTION

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COST EVALUATION OF NINE FEDERAL MOTOR VEHICLE STANDARDS
VOLUME V FMVSS 213 CHILD SEATING SYSTEMS

INTRODUCTION

Under Contract DOT-HS-8-02015, the Contractor conducted a program to determine the consumer cost and weight of selected infant and child seats based on the standards effective 1 April 1971.

An Integrated Cost Sampling Plan was developed, approved by the Contract Technical Manager, and followed to obtain cost and weight of the systems.

Specimen infant and child seats were selected and purchased that represented several popular models sold at both automobile dealers and retail stores. Automotive industry type teardown and manufacturing cost estimating techniques were applied to develop cost and weight data for the implementation analysis.

Appendix A of this report represents a summary of cost elements and weight of components involved in the study. In Figure 1 elements of component cost are shown. The boxes with the solid lines contain data derived from the cost and weight processing of components of the systems studied. Those with dotted boxes considered in the estimating processing and the summarized results are contained in the costs in Appendix A.

In this study, the consumer cost is the summation of the variable cost, corporation other cost and profit and dealer markup. The variable cost is considered as those costs that vary with the volume of production and consist of the cost of direct material, direct labor and variable burden. The Other Cost and Profit consist of those items identified in Figure 1 and are:

- Indirect Material
- Indirect Labor
- Fixed Burden
- Tooling Cost
- Engineering and Warranty Cost
- Selling and Administration Cost
- Other Corporate Costs
- Corporation Profits
- Distributor Cost

The Dealer-Markup consists of the dealers expense and profit.

The costs included in Appendix A are variable cost, dealer wholesale, dealer mark-up, and consumer cost.

The variable costs of production of components are those incremental costs associated with that component. The major categorical contributors to variable costs are direct labor, direct materials, and variable burden. Other minor contributors to variable cost such as setup costs, where applicable, are included in the variable burden rate.

ELEMENTS OF CONSUMER COST

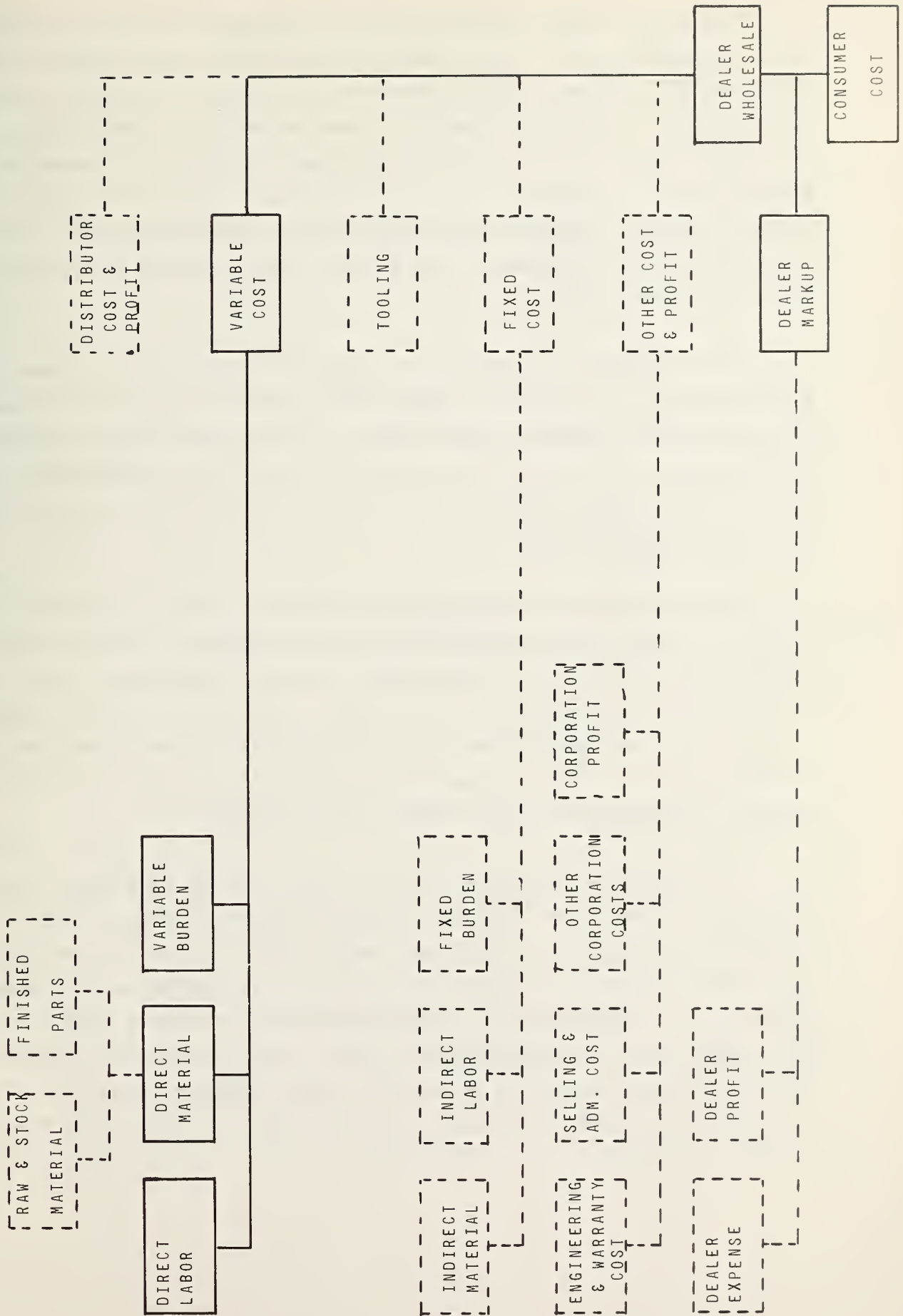


FIGURE 1

Direct labor costs are determined as an average rate depending on the worker classification required to perform the tasks identified in the process study (e.g., punch press operator, drill press operator, machinist). Average labor rates are determined from Union records, Department of Labor statistics, or a combination thereof. Labor fringe benefits and standard allowance for less than 100 percent labor efficiency are included in the average labor rate.

For each component, the process analysis identified the operation, type of equipment, pieces per hour, number of men, and number of machines. This data when extended by information from the data bank and all component operations summarized will produce the total direct labor cost per component.

Direct material costs are those costs associated with the purchase of all material required in the production process. Accordingly, direct material costs include the cost of not only the material in the finished component, but also that of the material scrapped minus salvage price, due to material removal or incorrectly worked components that cannot be salvaged.

Variable burden costs are estimated charges that attempt to account for all other expenses due to the production process and that vary directly with the production volume and that contribute to the cost of sales. Examples of sources of such expenses include, but are not limited to, perishable tools (e.g., drill bits, spot welding tips), fuel and power requirements and direct supervision and clerical. The total of all expenses

vary with the production quantity is estimated, based on a production planning volume. The sum of these expenses is then apportioned to each component on some logical scheme. The amount of apportionment is known as a variable burden rate.

Several methods of applying variable burden have been popularly accepted in the past as well as during current times. Total costs that are apportioned on the number of pieces produced, or material usage, misrepresent true costs whenever parts of different sizes or complexities are produced. Costs apportioned on direct labor misrepresent true costs in a highly automated production process.

This study utilizes a burden rate applied on occupancy time in a given machine, or station, performing a task during the production process. Burden rates are calculated on a basis of a combination of machine or station complexity, cycle time, area occupied, and other considerations that more realistically reflect the true rate of apportionment of total variable expenses.

The cost development process and teardown procedure requires that each component be weighed, tagged with identification data, and analyzed for general type of material and manufacturing method utilized. Experienced personnel qualified by many years of production processing were employed to develop the basic data. The processing method, specific manufacturing operation, type of equipment, pieces per hour, number of men, number of machines, general type of material, rough weight of material and tooling costs were all elements of data furnished by the process engineer. A finite estimating

and processing technique utilizes this basic data plus model year economics and volumes contained in a data bank to extend the data into consumer cost.

The data bank contains approximately six hundred operation rates and over sixty materials utilized in the automotive type industry and covers twelve model year economics. In this study, the terms "Model Year Economics" and "Model Year Production Volumes" are utilized. The term model year directly relates to a designated year of a vehicle design. Normally in the United States, the model year starts in retail sales approximately in September. The volume is related to the number of vehicles produced of a specific design year vehicle. The term economics relates to the average cost elements involved in the production of a specific car year. The model production years normally are not related to the calendar year or a corporation fiscal year. For this study, the Contract Technical Manager designated the Model Year Economics to be 1979.

The Dealer Wholesale Cost for this study was developed by use of the Macro-analysis Method. A factor expressing the relationship of the variable cost to the Dealer Wholesale Cost was obtained from studying financial data related to the specific industry or manufacturer of the product. The macro-analysis study utilized data obtained from public files, annual financial reports, the 10K Report filed annually by the United States manufacturers and previous cost studies of similar products. The variable cost multiplied by the factor will produce the dealer wholesale cost.

Although other methods can be used to derive a dealer wholesale cost, it is believed by the Contractor

that the variable cost macro-analysis factor method produces an acceptable average dealer wholesale cost. The macro-analysis factor includes:

- A. Indirect labor - these costs are determined by apportioning the total estimated wages for indirect labor over the planned production volume. Indirect labor is comprised of, but not limited to, supervision and management, clerical, janitorial, plant security, etc. The total labor cost is not affected by variations in the production rate.
- B. Indirect material - these costs are determined by apportioning the total estimated costs for all material necessary for the proper functioning of the manufacturing plant and not related to the finished product over the planned production volume. Indirect materials are comprised of, but not limited to, stationery and office supplies, janitorial supplies, maintenance supplies, first aid and medical supplies, etc.
- C. Fixed Burden - is determined by apportioning the remaining estimated expenses related to the operation of a manufacturing plant over the planned production volume. All such expenses are conveniently accumulated categorically as burden. Such expenses are comprised of, but not limited to, property taxes, insurance costs, depreciation charges on buildings and capital equipment, etc.

- D. Tooling Cost - is determined by apportioning the total expense by special tooling to manufacture a component over the entire life production volume of that component. This cost factor could vary as the component or sub-component could have several years application beyond the study period of a program. Further, the component or sub-component could be extended over several product lines. Thus the years of amortization and production volumes could have a definite bearing on the tooling cost of the component. With this knowledge, the process engineer would be required to use judgment in the application of the amortization and volume factor.
- E. Other Cost and Profit - include items of engineering cost, warranty costs, selling and administrative costs, corporate burden and taxes (excluding factory burden and taxes), corporate depreciation and maintenance (excluding factory depreciation and maintenance), and other corporate costs and profit.

The dealer wholesale cost could be derived by the method of applying individual detailed cost factors stated above to the variable cost. This would produce a very accurate dealer wholesale cost. However, the data to accomplish this would not be available publicly or could it be expected that such confidential data would be made available for study groups.

Dealer Markup is the summation of all costs incurred in the operation of a dealership (salaries, taxes, depreciation, advertising, maintenance, etc.) and the dealer's profit. The Contractor was cognizant of a potential problem in attempting to arrive at an equitable dealer markup to apply in the cost calculations. The United States dealer is an independent business man over whom the manufacturer can exercise only limited controls. Although manufacturers have suggested retail prices, the dealer is actually free to bargain with each customer to establish the selling price for a vehicle. For this study it is assumed that the dealer's markup is based upon the full suggested price and is reflected in the consumer cost of the system or components studied.

Appendix B contains photographs for each system studied. These photographs provide a quick overview of the various systems.

Cost and weight data in Appendix A shows data to four decimal places. This does not indicate the degree of accuracy, but rather the result of the system used to develop the final weight and costs.

INTEGRATED COST SAMPLING PLAN

The Contractor developed an Integrated Cost Sampling Plan that provided for the selection of specimen infant and child seating systems. Table 1 indicates the seat system, manufacturer, type and identification number that was purchased and studied.

A standard teardown cost processing method was used to develop the specimen weight and consumer costs. The summary of data is contained in Appendix A. Photographs of the systems studied are contained in Appendix B.

TABLE 1

FMVSS 213 - CHILD SEATING SYSTEMS
 INFANT AND CHILD SEATS PURCHASED FOR STUDY

MANUFACTURER	CLASS		
	INFANT	CHILD	SPECIAL
General Motors Corporation	796505	9677326	
Bunny Bear		No. 48	
Questor Juvenile Furniture Company	440	988	
Peterson Baby Products Co.			No. 78 2 Position
Peterson Baby Products Co.			No. 75 3 Position
Chrysler Corporation	XXX	XXX	
Ford Motor Company		D4AZ19E535-A	
Century Products, Inc.		4448	

COST EVALUATION - CHILD SEATING SYSTEMS

The standard governing the performance of child seating systems became effective on 1 April 1971. The child seat, unlike the other vehicle systems is unique in that it is most frequently purchased separately from the automobile. It is sold by many outlets other than car dealers including department stores and children's specialty stores.

This contract required that the consumer cost and weight be obtained from selected specimens. This information is listed in Table 2.

The child seating business is extremely competitive and the manufacturers do not suggest retail prices. Sales volume for the industry appears to be in excess of 500,000 units per year. The following are high volume manufacturers:

Strole
Peterson
General Motors
Century

Annual sales of the GM Infant Seat is estimated to be in excess of 130,000 units. The GM Child Seat sales volume is estimated to be 75,000 units.

The cost estimates were prepared using 1979 year economics, tooling and amortized using a volume of 100,000 units over five years.

TABLE 2

CONSUMER COST, WEIGHT, AND PRODUCTION DATA ON SELECTED SEATS STUDIED

MANUFACTURER	WEIGHT POUNDS	CONSUMER COST \$	PRODUCTION REMARKS
GM INFANT	6.1	26.50	*
GM CHILD	8.8	47.50	**
BUNNY BEAR CHILD	10.6	46.00	**
QUESTOR INFANT	4.5	19.99	**
QUESTOR CHILD	9.6	40.99	**
PETERSON 75	8.8	46.00	*
PETERSON 78	11.1	50.00	*
CHRYSLER INFANT	6.6	24.95	**
CHRYSLER CHILD	8.4	37.80	***
FORD CHILD	8.1	37.75	***
CENTURY CHILD	10.8	49.95	**

PRODUCTION QUANTITIES

* Greater than 100,000 units

** 50,000 to 100,000 units

*** Less than 10,000 units

Although not a part of this contract, the following is a list of features of some of the specimen studied:

General Motors

Child Seat

- 1) To be used on forward facing seats.
- 2) Cannot be used on hinged seats not equipped with a latch.
- 3) Has five point safety harness similar to Air Force pilot equipment.
- 4) A special mounting kit is available with instructions for use in small cars and trucks.
- 5) Rear seat use requires that a metal shelf panel be available to anchor the top seat strap.

General Motors

Infant Seat

- 1) Seat maybe used in front or rear seat.
- 2) Seat is designed for rearward facing.
- 3) Must be used with fasten loop seat belts.
- 4) All folding front seats must be equipped with a latch.

Bunny Bear

Child Seat

- 1) Design to be used only in forward facing position.
- 2) This seat cannot be used where auto shoulder belts are permanently attached to the auto lap belt.
- 3) This seat is recommended for use in the center of the rear seat and can be used as either an infant or child seat.

Questor

Infant Seat

- 1) Can be used with auto lap belts.
- 2) Unit equipped with safety wings for head protection.

Questor

Child Seat

- 1) Has a five point seat belt harness.
- 2) Unit can be used in a reclining position, rear facing position or forward position.

Peterson #75

- 1) Can be used as an infant seat using the harness as a shoulder belt and the car lap belt.
- 2) Used as a toddler seat with the use of arm rest panel assembly and pad.
- 3) Used as a child seat without the arm rest panel assembly and pad.

Peterson #78

Infant and Toddler Seat

- 1) This is a two seat system for upright and reclining positions.
- 2) Equipped with padded arm rests and wings.

Ford

Child Seat

- 1) Can be used with shoulder and lap belts in the front seat.
- 2) Can be used with lap belts for rear seats.

Chrysler

Infant

Basically the same as GM Infant Seat

Chrysler

Child

Uses standard seat belt system.

Century

Child Seat

- 1) Suggest for use in rear seat of car and in the center of the seat.
- 2) Unit is designed for rearward facing as well as a forward and forward reclining position.
- 3) Uses lap belts for all positions.
- 4) Has a shoulder harness and five point belt system.

CONCLUSION

The consumer cost of the infant seats varied from \$20.00 to \$26.50 and the weight varies from 4.5 to 8.8 pounds. The consumer cost of the child seats varied from \$40.97 to \$49.95 and the weight varies from 8.8 to 10.8 pounds. The seats are sold by car dealers, discount and retail stores. There is no firm retail price on any seats purchased for this study. A consumer does have a selection of basic manufacturer with different seat features and a range of cost.

APPENDIX A

SUMMARY OF COMPONENT COST AND WEIGHT DATA

FMVSS -- 213 CHILD SEATING SYSTEMS SUMMARY OF COMPONENT COST AND WEIGHT DATA

[illegible]

APPENDIX B

PHOTOGRAPHS

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GENERAL MOTORS CORPORATION
INFANT SEAT



GENERAL MOTORS CORPORATION
INFANT SEAT



GENERAL MOTORS CORPORATION
INFANT SEAT



GENERAL MOTORS CORPORATION
INFANT SEAT



GENERAL MOTORS CORPORATION
CHILD SEAT



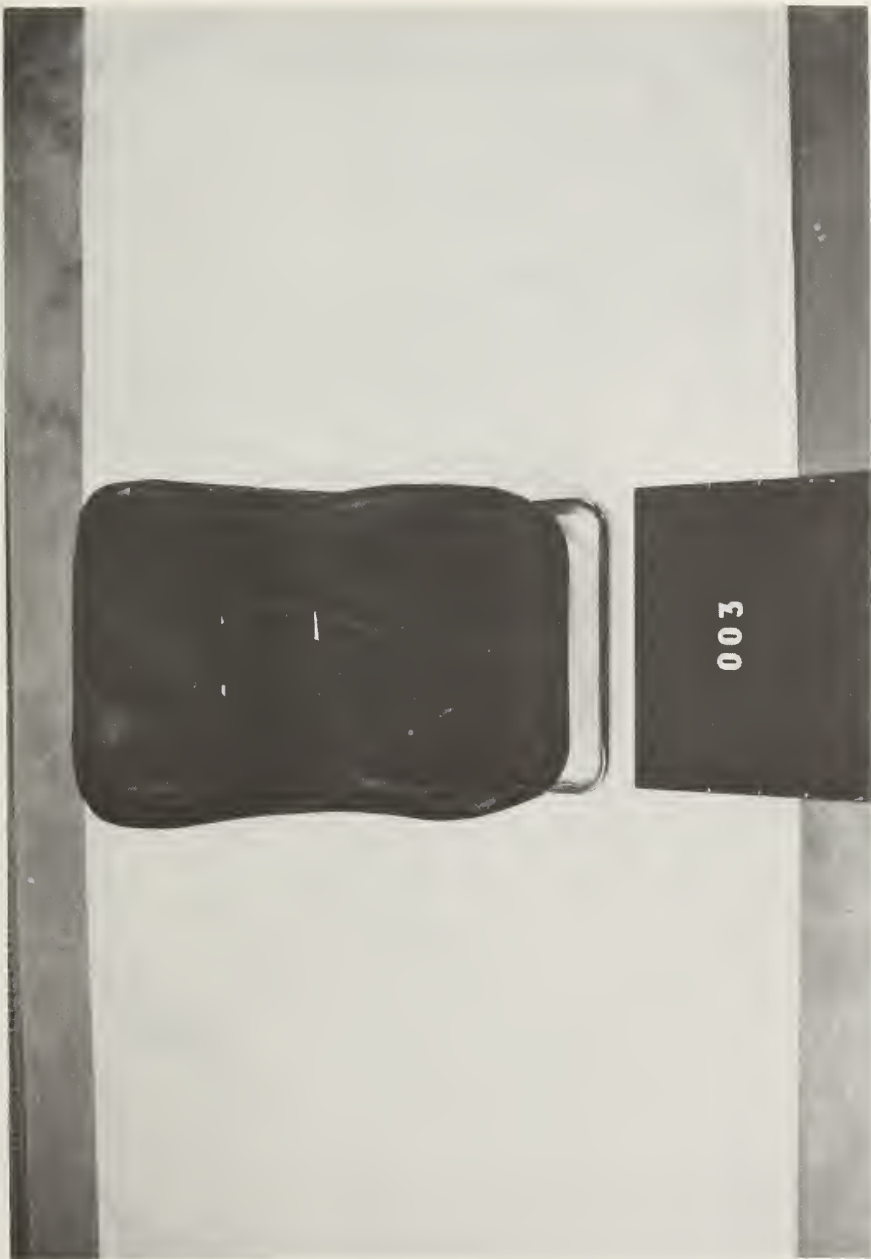
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CHILD SEAT



GENERAL MOTORS CORPORATION
CHILD SEAT



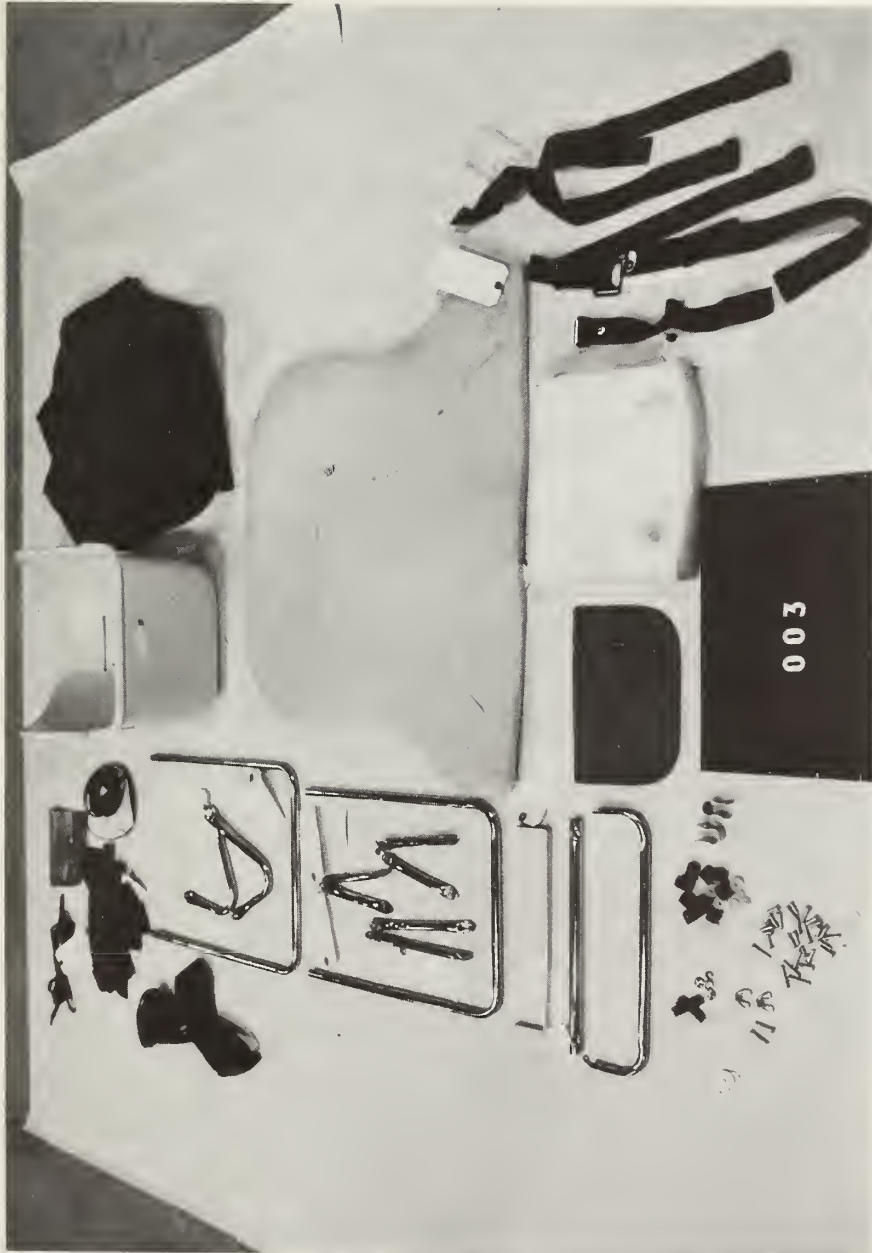
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CHILD SEAT



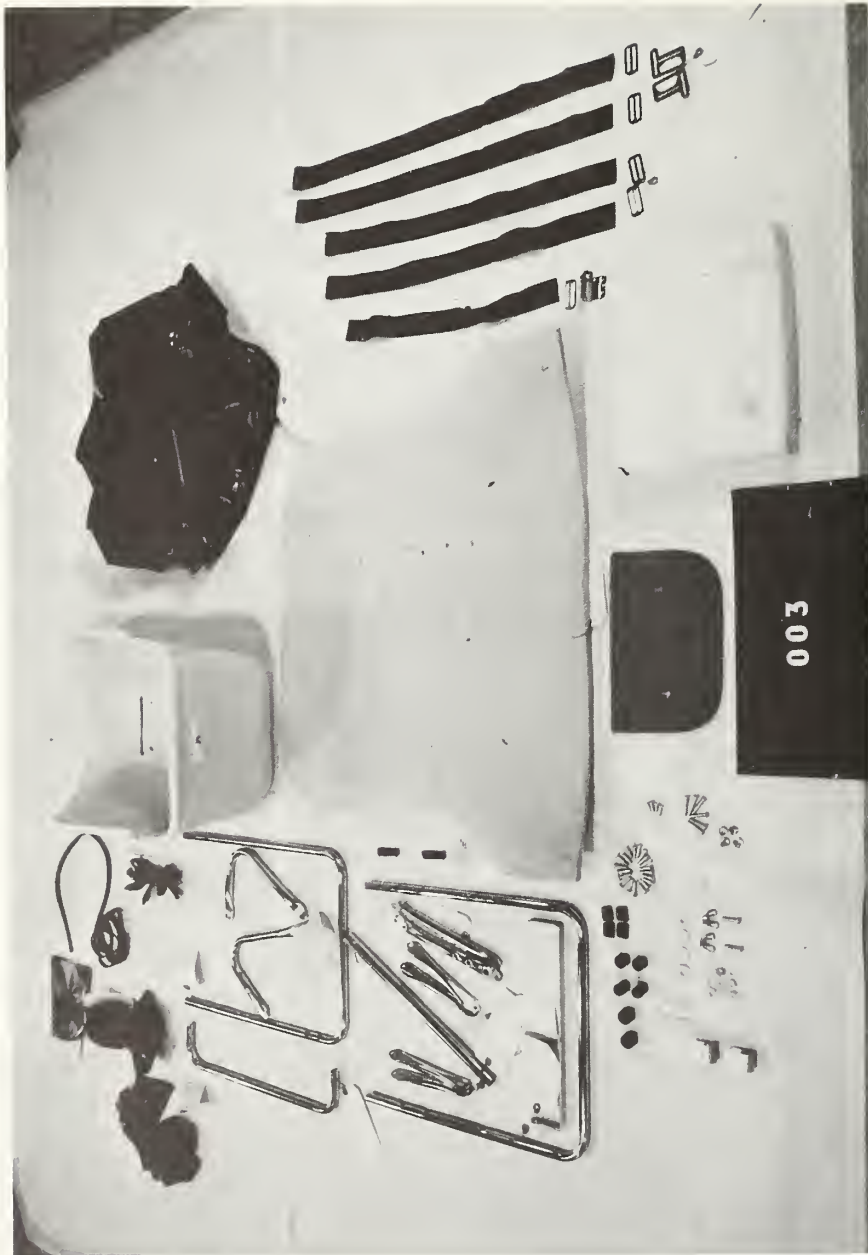
BUNNY BEAR
CHILD SEAT



BUNNY BEAR
CHILD SEAT



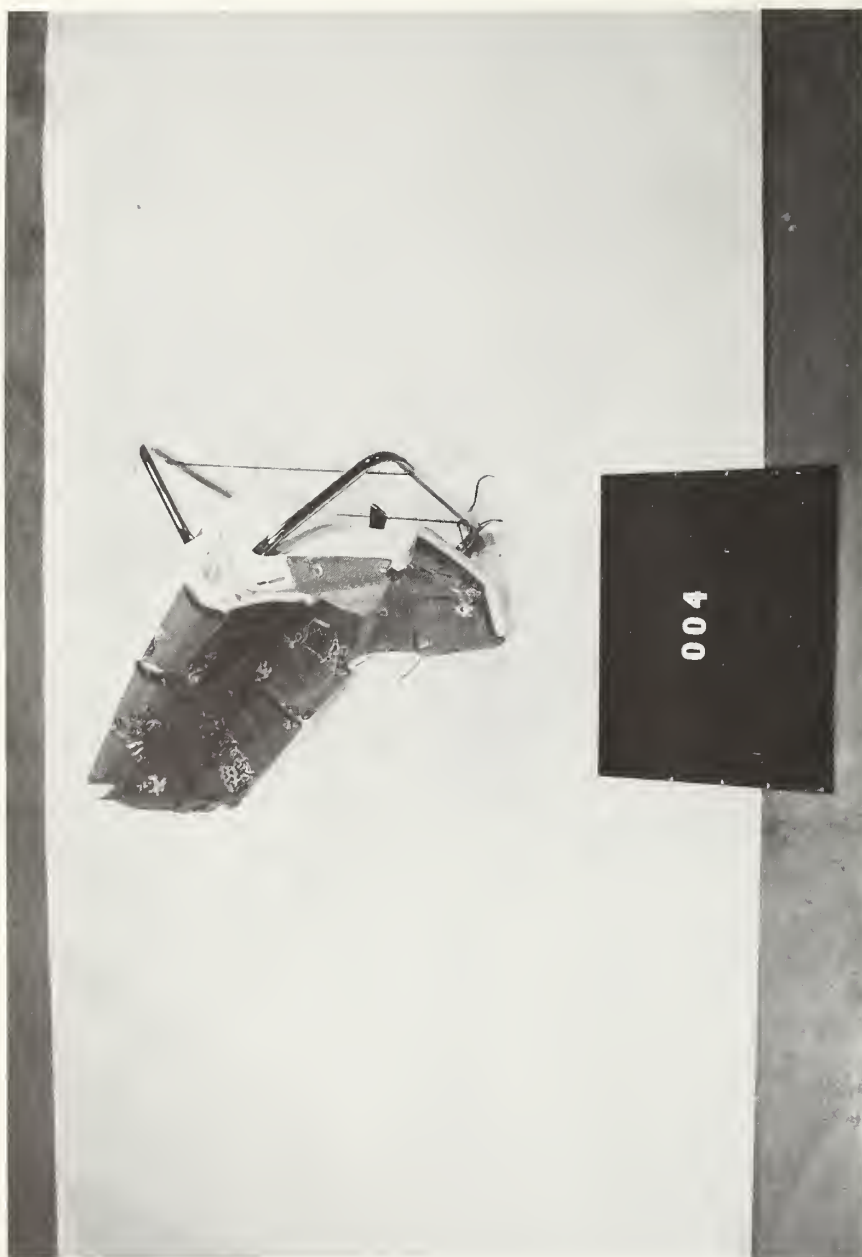
BUNNY BEAR
CHILD SEAT



BUNNY BEAR
CHILD SEAT



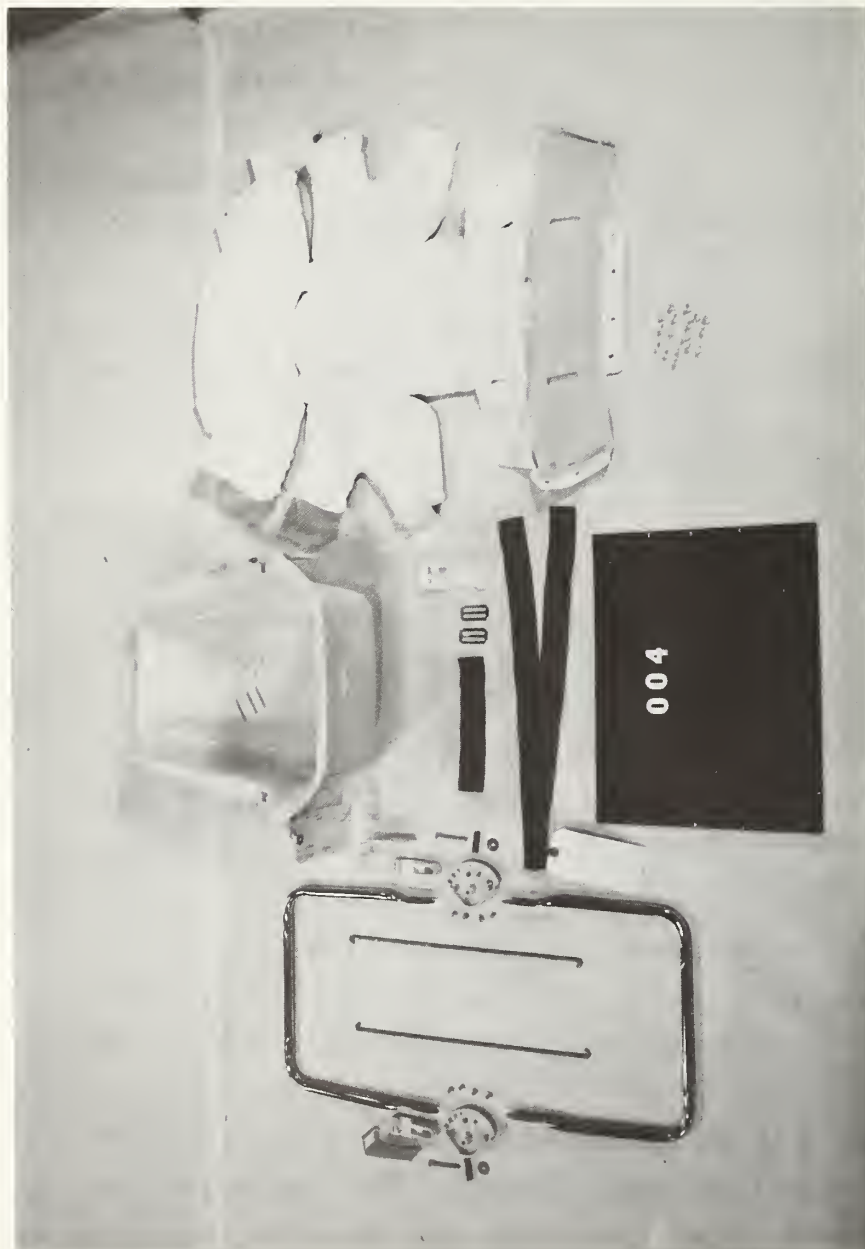
QUESTOR JUVENILE FURNITURE CO.
INFANT SEAT



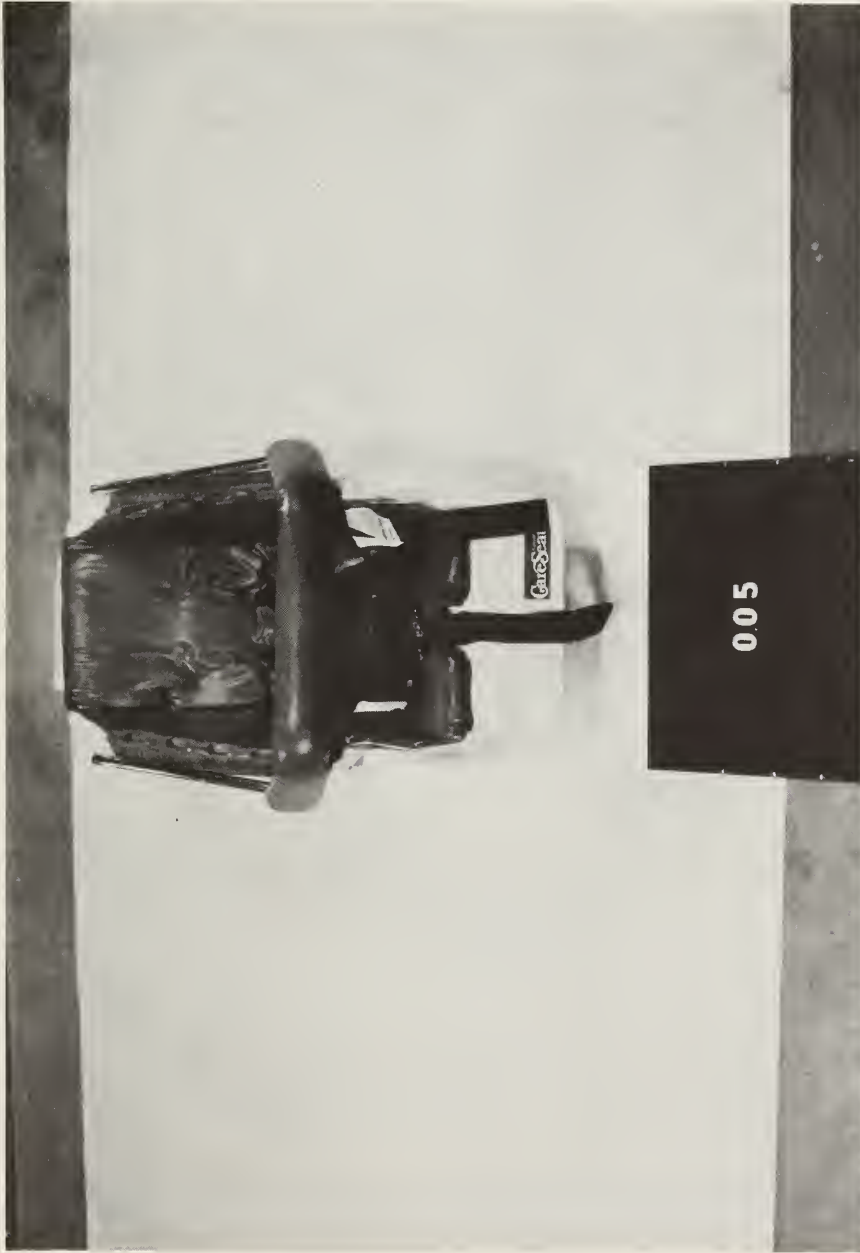
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QUESTOR JUVENILE FURNITURE CO.
CHILD SEAT



QUESTOR JUVENILE FURNITURE CO.
CHILD SEAT



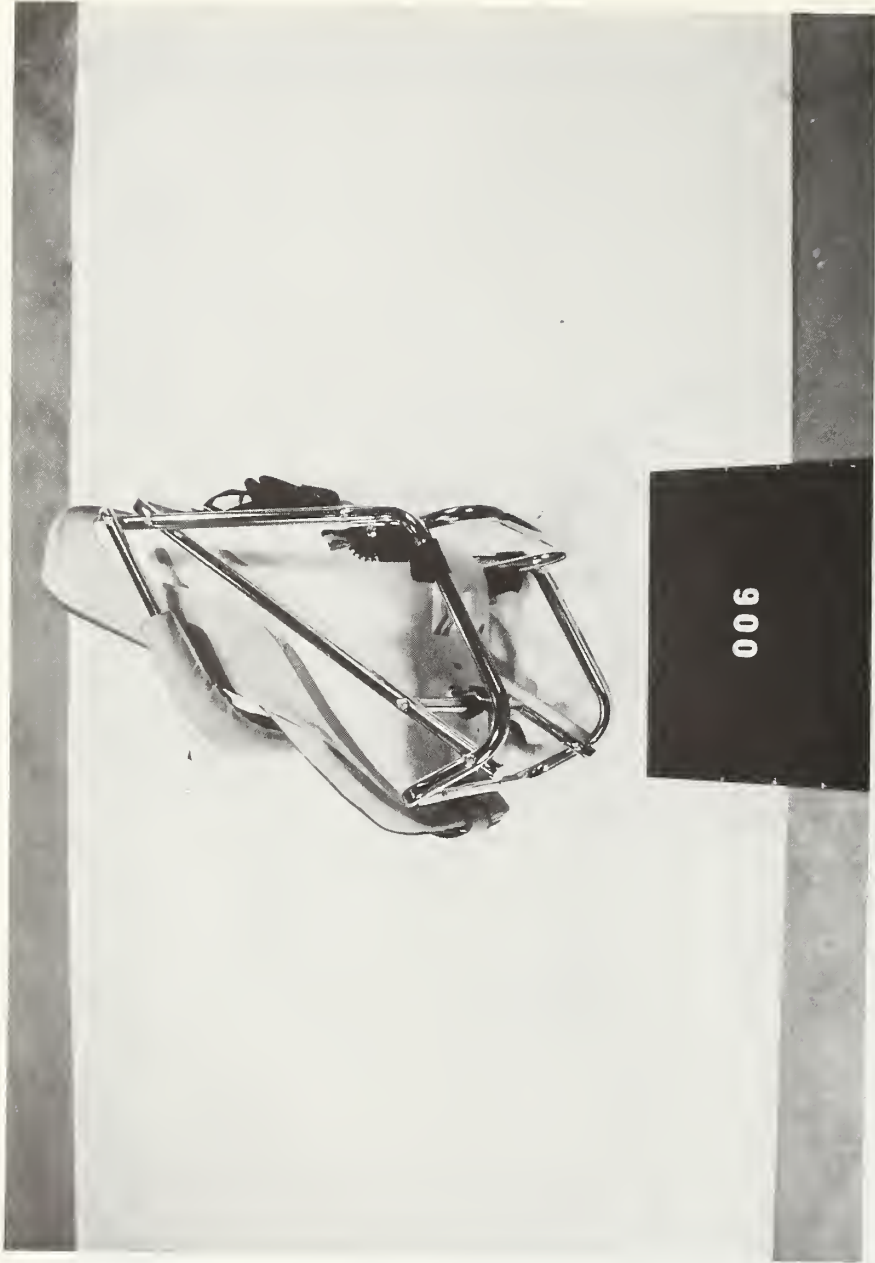
QUESTOR JUVENILE FURNITURE CO.
CHILD SEAT



QUESTOR JUVENILE FURNITURE CO.
CHILD SEAT



PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 2 POSITION



PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 2 POSITION



PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 2 POSITION



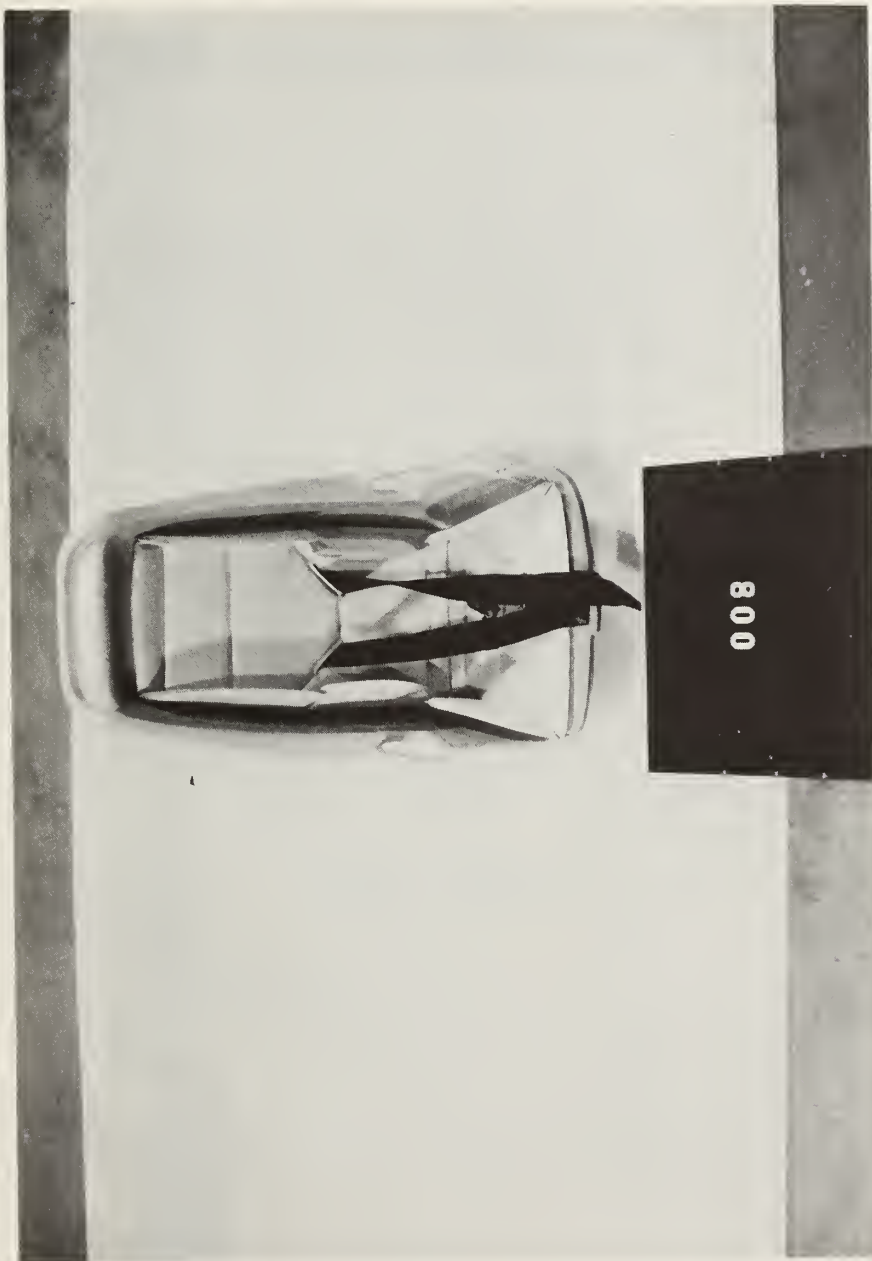
PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 3 POSITION



PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 3 POSITION



PETERSON BABY PRODUCTS CO.
SPECIAL SEAT 3 POSITION



CHRYSLER CORPORATION
INFANT SEAT



CHRYSLER CORPORATION
INFANT SEAT



CHRYSLER CORPORATION
INFANT SEAT



CHRYSLER CORPORATION
INFANT SEAT



CHRYSLER CORPORATION
CHILD SEAT



CHRYSLER CORPORATION
CHILD SEAT



CHRYSLER CORPORATION
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CHRYSLER CORPORATION
CHILD SEAT



FORD MOTOR COMPANY
CHILD SEAT



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CHILD SEAT



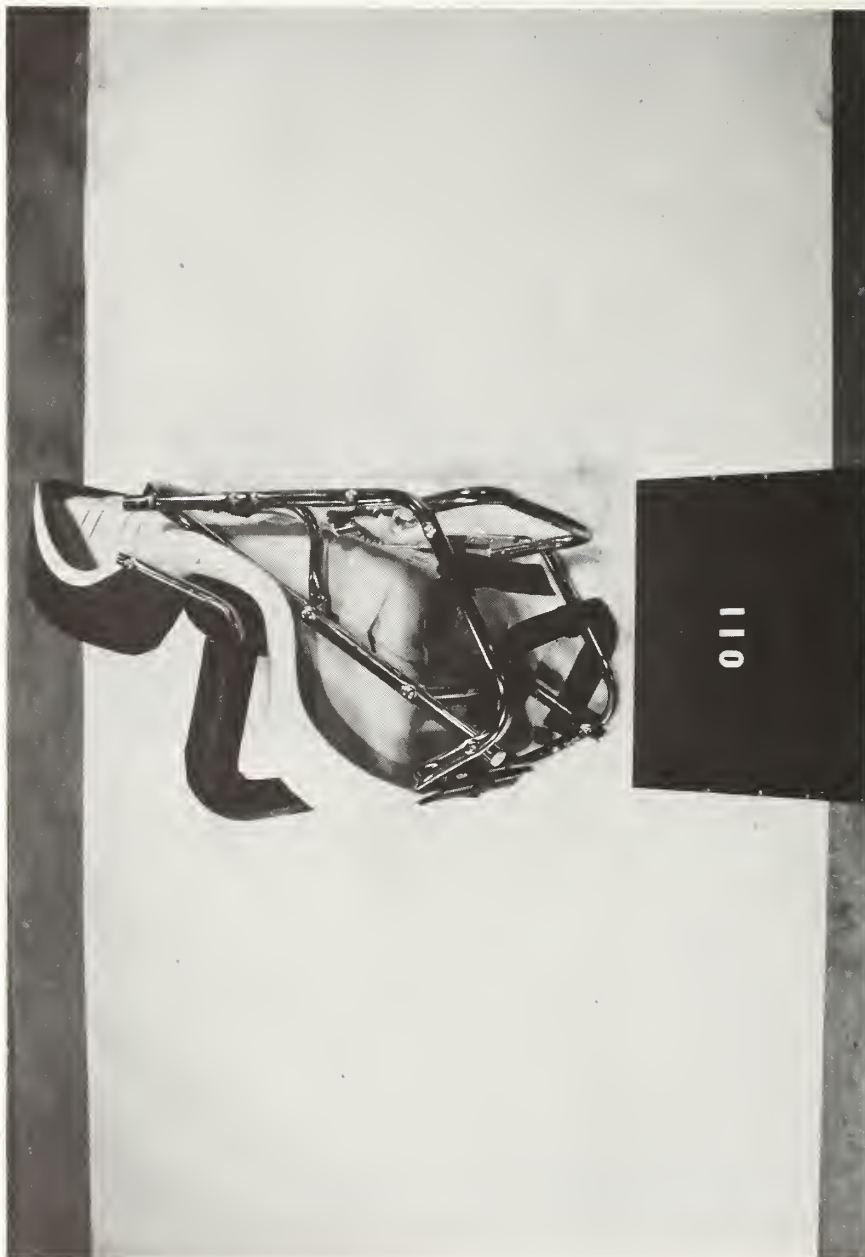
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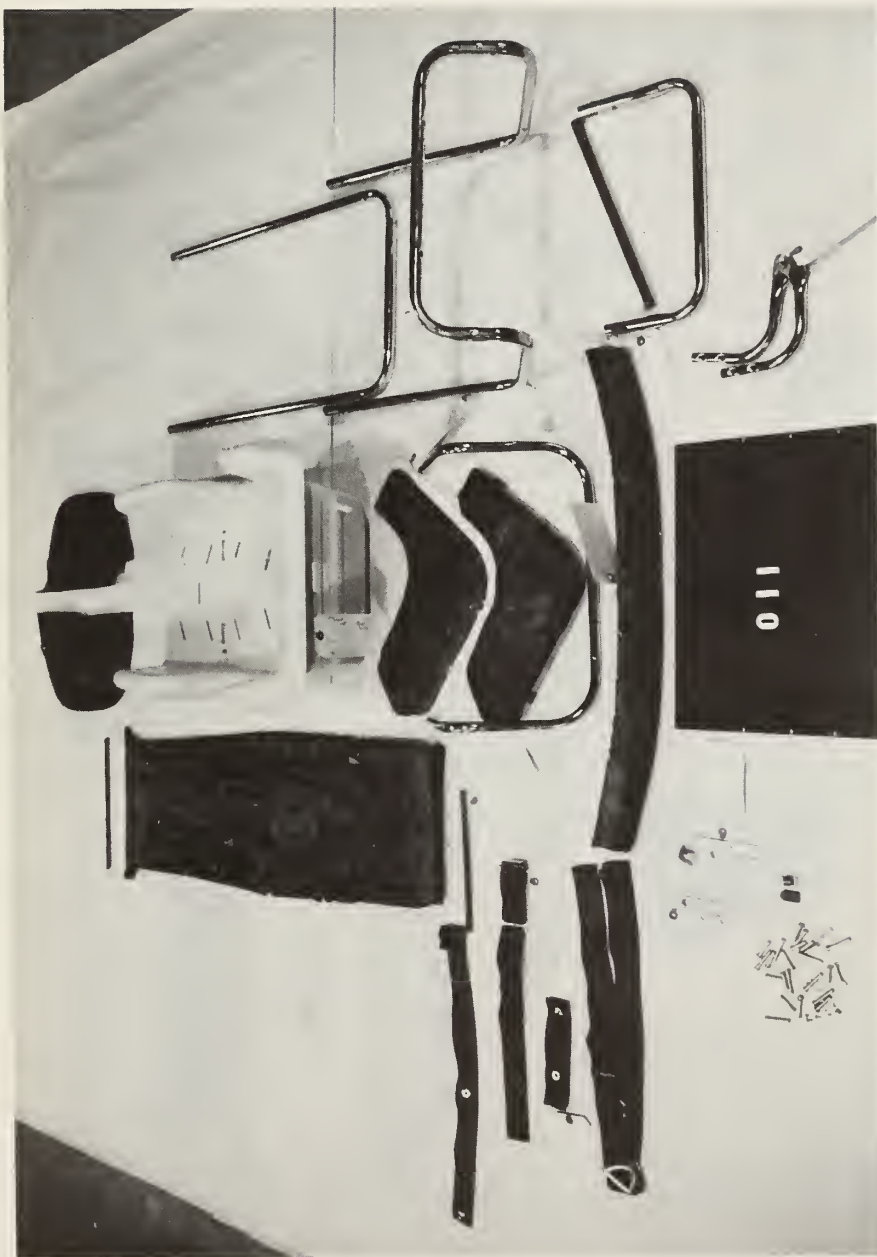
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